NIAGARA SPRINGS FISH HATCHERY

2004 Steelhead Brood Year Report

By:
R. Paul Dorman, Assistant Hatchery Manager
Jerry Chapman, Fish Hatchery Manager II

August 2005
IDFG 05-40

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

ABSTRACT

Niagara Springs Fish Hatchery (NSFH) received 2,058,113 steelhead (*Oncorhynchus mykiss)* eggs and fry during the 2004 brood year. A total of 1,133,186 Pahsimeroi stock eggs and fry (372,192 eggs and 760,994 swim-up fry) were received from Oxbow Hatchery. After spawning, Pahsimeroi stock eggs were shipped green to Oxbow Hatchery for incubation on chilled well water and then transferred to NSFH as eyed eggs or swim-up fry. More than two-thirds (67.16%) of the Pahsimeroi egg lots were shipped to NSFH as first feeding fry. This is almost a twenty percent (18.12%) increase from the previous year. A total of 924,927 Hells Canyon stock eggs and fry (461,769 eggs and 463,158 swim-up fry) were received from Oxbow Hatchery. Approximately 50% of the earliest Hells Canyon egg lots were shipped to NSFH as first feeding fry.

Total production for the 2004 brood year at NSFH was 1,705,078 steelhead (369,600 lbs) for anadromous smolt releases. No excess fish were available to be stocked as fall releases.

A total of 1,705,078 steelhead smolts (369,600 lbs at 4.61 fish/lb) were released into the Snake and Salmon rivers from March 14 to April 21, 2005. A total of 820,667 smolts (187,900 lbs at 4.37 fish/lb) of Pahsimeroi stock were released in the Pahsimeroi River at the weir, and 114,922 smolts (23,450 lbs at 4.90 fish/lb) of Pahsimeroi stock were released in the Little Salmon River near Hazard Creek. A total of 526,024 smolts (106,600 lbs at 4.93 fish/lb) of Hells Canyon stock were released in the Snake River at Hells Canyon Dam, and 243,465 smolts (51,650 lbs at 4.71 fish/lb) of Hells Canyon stock were stocked in the Little Salmon River near Hazard Creek.

Mortalities from pathogens were well below normal this year. For this brood year, fifty percent (50%) of the total steelhead production was vaccinated for furunculosis (*Aeromonas salmonicida).* No steelhead at NSFH were vaccinated for enteric redmouth disease (ERM-*Yersinia ruckerii)* during this brood year. Furunculosis, ERM, and Infectious Hematopoietic Necrosis Virus (IHNV) were not isolated during the 2004 brood year. Coldwater disease (*Flavobacter psychrophilum)* and *Aeromonas hydrophila* caused minor mortality just prior to release.

A total of 367,493 lbs of fish feed were fed (360,893 lbs of Rangen and 6,600 lbs of Skretting (formerly Moore-Clark)) at a cost of $151,326.09 to produce 369,600 lbs of steelhead for a conversion rate of 0.994:1.

Authors:

R. Paul Dorman, Assistant Hatchery Manager

Jerry Chapman, Fish Hatchery Manager II

INTRODUCTION

The NSFH is owned and financed by Idaho Power Company (IPC), and operated and staffed by the Idaho Department of Fish and Game (Department). It is located in the Snake River Canyon, ten miles south of Wendell, Idaho. The NSFH is one of four hatcheries IPC owns and which the Department staffs and operates that fulfill IPC's mitigation requirement under the Federal Energy Regulatory Commission license #1971. The goal of NSFH is to rear 400,000 pounds (lbs) of steelhead smolts annually. Originally, these smolts were used to relocate a portion of the Snake River steelhead run into the Salmon River. Since 1980, 200,000 lbs of production are used to sustain a steelhead run below Hells Canyon Dam in the Snake River, and 200,000 lbs are stocked in the Salmon River drainage.

OBJECTIVES

The two major mitigation requirements that must be met at IPC's NSFH are to produce quality steelhead smolts to sustain steelhead trout runs in the Snake River below Hells Canyon Dam and in the Salmon River and its tributaries by successfully meeting these objectives:

1. Rear 200,000 lbs of quality steelhead smolts to be released in the Salmon River and its tributaries. The steelhead are to return as adults in sufficient numbers to provide quality sport fisheries in these waters and to supply sufficient broodstock (1,000 adults) to the Pahsimeroi Fish Hatchery for the collection of spawn for the next production cycle.

2. Rear 200,000 lbs of quality steelhead smolts to be released in the Snake River below Hells Canyon Dam. These are to return as adults in sufficient numbers to provide a quality sport fishery in the Snake River and to supply sufficient broodstock (1,000 adults) to the Hells Canyon Trap for the collection of spawn for the next production cycle.

IDAHO DEPARTMENT OF FISH AND GAME GOALS

1. Provide quality steelhead smolts to the Snake and Salmon rivers that will survive downstream migration and return as adults in sufficient numbers to provide a quality sport fishery in these waters and their tributaries.

2. Provide quality hatchery steelhead for supplementation where wild stocks of steelhead have diminished below desired levels and where managers feel quality hatchery steelhead would enhance the fisheries resource.

3. Enhance the genetic quality of hatchery stocks through management and hatchery practices that favor genetic variability.

FACILITY DESCRIPTION

Fish culture facilities at NSFH consists of an indoor nursery area, outdoor rearing raceways, and two flow-through settling ponds. Spring water supplies 42 upwelling incubators and 21 rectangular vats for the hatching and early rearing of fry. The nursery tanks provide 749.61 ft^3 of hatching and early rearing space.

The outdoor rearing space consists of nineteen raceways (300-ft x 10-ft), (142,500 $ft^{3)}$, which are supplied by constant temperature, gravity flow, spring water. This allows for the production of 400,000 lbs of steelhead at a density index of less than 0.35 lbs/ft^3/in as recommended by Piper (1982).

Two flow-through settling ponds (150-ft x 60-ft) are provided to remove settleable solids from the NSFH effluent. The settling ponds handle all the flow from the raceways and meet Environmental Protection Agency (EPA) guidelines for aquaculture discharge.

Dissolved nutrients are monitored on a biweekly basis to comply with the terms of a consent order between IPC and the Idaho Division of Environmental Quality. Samples of inflow, raceway effluent, and settling pond discharges to Niagara Springs Creek and Rimview Trout Company are collected using Sigma automated water samplers and sent to Rangen Aquaculture Research Center for analysis. Additional water analysis is performed monthly in accordance with the EPA National Pollutant Discharge Elimination System permit. Samples are collected only on inflow and discharge water. The Rangen Aquaculture Research Center conducts nutrient analysis, while the Department's Eagle Fish Health Laboratory completes analysis for total suspended solids.

Swim-up fry are hand fed in all nursery areas with some supplementation from the use of Ziegler belt feeders. Once the fish reach approximately 75 fish per pound (fpp) they are transitioned to the automated feed delivery system. Two moveable bridges span the outdoor rearing area. A total of 19 Nielsen automatic feeders are mounted on the bridges. The fish are fed by moving the bridges down the length of the rearing area and energizing the individual feeders on the control panels. Bulk feed is dispensed to the feeders by a conveyor supplied by two 20,000-lb storage bins with an associated fines separator.

Raceway cleaning is accomplished with an automatic air blower system. Three blower motors supply approximately 10 psi of air to weighted, perforated, airlines on the bottom side corner of each raceway. The resulting bubble screen creates a vortex of water currents that keep waste material suspended along the length of the raceways. While this system saves many hours of labor sweeping raceways, it is not completely efficient. Raceways are broomed as necessary to augment the air blower system and a power scrubber is also employed on a regular basis to remove excessive algal growth.

Buildings on the NSFH grounds include five residences. Three are wood-frame houses, one is a doublewide modular home, and one is a 16-ft wide mobile home. A 32-ft x 80-ft metal building contains an office, two incubator rooms, garage, shop, and feed storage room. Additional buildings include: two screen storage buildings (14-ft x 24-ft and 10-ft x 12ft), an open front shed (10ft x 30ft), and a masonry block chiller building (70-ft x 45-ft) which contains the chiller and blower-electrical room, a heated shop, and garage.

The NSFH staff is also responsible for care of the IPC-owned two-acre park adjacent to Niagara Springs Creek. It has a public, handicapped-accessible restroom, picnic tables, BBQ grills, and refuse containers.

WATER SUPPLY

In addition to NSFH, Niagara Springs supplies water to Rimview Trout Company, Niagara Springs Wildlife Management Area, and Idaho State's Pugmire Park. Niagara Springs' total flow is 220 cubic feet per second (cfs), which is divided into water rights by the four users.

The IPC has entered into an agreement with the four other users of Niagara Springs water whereby NSFH will receive water according to a stepped flow chart (Appendix 1). The NSFH has a water right of 132 cfs. A diversion canal was built by IPC in 2001, allowing up to 75 cfs of water to be discharged to Rimview Trout Company from November through April. This canal crosses onto Rimview property and attaches at their second-use head-ditch. Three slide gates located in the east and west settling basins regulate the volume of water discharged to Rimview. The volume of water discharged to Rimview this season is summarized by month in Appendix 2.

Water from Niagara Springs is a constant 59°F and flows by gravity to the incubators, nursery vats, outdoor raceways, fire hydrants, and irrigation system. Water quality is checked annually during the spring at the NSFH for herbicides, pesticides, heavy metal contaminants and normal water chemistry parameters (Appendix 3).

STAFFING

Four permanent personnel staff the NSFH. Jerry Chapman, Fish Hatchery Manager II, Paul Dorman, Fish Hatchery Assistant Manager, Travis Brown and Doug Young, Fish Culturists, handle most operational duties. During peak work activities there are several Bio Aides throughout the year: Mike Anderson, Chris McRoberts, Glen Owsley, and Brad Brinkley who assist the permanent staff with culture, maintenance, and other assignments.

FISH PRODUCTION

Egg Shipments and Early Rearing

Eggs and fry received at NSFH originate from broodstock trapping and spawning operations at IPC's Oxbow and Pahsimeroi hatcheries. To retard embryonic development, steelhead eggs spawned at Pahsimeroi Hatchery were transported by aircraft to Oxbow Hatchery for incubation in chilled wellwater (43°F) prior to delivery to NSFH. This procedure was done to control smolt size while minimizing the need to take fish off feed during the rearing cycle at NSFH. At the Oxbow Hatchery, a 70 horsepower chiller unit was utilized to chill 52°F wellwater to 43°F for incubation. Pahsimeroi Hatchery does not have a chiller unit for this purpose. The NSFH received both eggs and fry for the 2004 brood year (Appendix 4). Of the

Pahsimeroi stock eggs incubated at Oxbow Hatchery and destined for NSFH, approximately one-third (32.84%) were delivered to NSFH as eyed eggs while the balance (67.16%) were delivered as first feeding fry. This brood year saw an 18.12% decrease in eyed eggs and subsequent increase of fry received at NSFH. This was created due to concerns over water quality and amounts of water delivered to the incubation building. Eyed eggs were transported in conventional coolers while fry were transported in specially designed, perforated fry transport tubes; and placed inside a 500-gallon fish-stocking tank acquired by NSFH from Hagerman State Fish Hatchery (HSFH).

The 500-gallon tank is mounted to a trailer and towed by a 3/4-ton hatchery vehicle. The tank is equipped with Point-4 ceramic air stones and bottled oxygen. This tank and trailer design was created in 2002 to help prevent the possible transmission of disease pathogens between hatcheries. This tank/trailer configuration also eliminated the transportation bottleneck created when NSFH wanted to use HSFH transport trucks during their busy "catchable" stocking season.

The NSFH received 372,192 eyed-eggs of Pahsimeroi stock between June 14 and June 18, 2004. This is one week later than the prior brood year and came from lots 13 and 14. A total of 760,994 Pahsimeroi stock swim-up fry from egg lots 4-13, were received from July 13 through July 23. The last of the fry were received 5 days later than the prior brood year. A total of 1,133,186 eggs and fry of the Pahsimeroi stock were received at NSFH for the 2004 brood year.

A total of 461,769 eyed-eggs of Hells Canyon stock (lots 10-18) were shipped to NSFH from June 1 through June 8, 2004. Egg lots 1-9 were transported to NSFH as swim-up fry (463,158) between June 25 and July 6, 2004, and placed directly into outdoor nursery raceways. The timing of the fry shipments coincided with the swim-up timing of fish from the eyed-eggs that were received earlier at NSFH, and was approximately 16 days earlier than the prior brood year. A total of 924,927 eggs and fry of Hells Canyon stock were received at NSFH for the 2004 brood year. NSFH's steelhead egg to smolt survival for brood year 2004 is summarized in Appendix 4.

Upon arrival at NSFH, all eggs were tempered and disinfected with iodine at 100-ppm for 30 minutes and placed in upwelling incubators (26,500 per incubator) inside the vats. All fry shipping containers were disinfected prior to shipping. Upon arrival at the hatchery, fry were tempered in their shipping containers before ponding.

Fry were not inventoried from the nursery vats to the nursery raceways this brood year. Consequently, hatching success and mortality could only be estimated. The NSFH staff observed above-normal losses to eyed eggs during the early rearing cycle. Survival of fry to fingerling was 83.79% in Pahsimeroi steelhead and 84.96% in Hells Canyon steelhead. Overall, fry to fingerling survival was 84.38%.

As was done last year, nursery sections were screened at both ends and remained expanded from 20-ft to 35-ft in length. This effectively prevented fry and fingerlings from getting into the headrace, and allowed the fry to be reared at lower starting densities. As densities increased, fry were given more rearing volume by relocating screens to 50-ft, 75-ft, and finally, to the end of the first section at 100-ft. In 2001, additional screen brackets were placed at 75-ft and 150-ft allowing for greater flexibility than the standard keyway distances of 100, 200, and 300-ft. This methodology reduces wasted feed and reduces cleaning times created by using the standard keyway distances, yet still allows densities to be lowered and greater management of

inventories. This practice was expanded even more, during the 2003 brood year, by creating screen brackets at 250-ft for the Coded-Wire-Tag (CWT) raceways. These CWT raceways have approximately 30,000 to 60,000 untagged steelhead per raceway, depending on the stock and tagging requests. In the production cycle, these 30,000 to 60,000 fish require less or more than the normal 100-ft key-way sections depending on the number. This allows for better cleaning, feeding and density control. Fish are given more room before they attain a density index of 0.30. All of these fish culture changes will continue in future brood years.

Throughout the entire early rearing period, steelhead at NSFH were fed Rangen dry feeds. Feed was dispensed by hand feeding and supplemented with Ziegler belt feeders in the indoor and outdoor nursery areas. When the fingerlings reached approximately 275 fish/lb they were fed Skretting's "Clarks Fry" (ProActive) dry feeds for 14 days. The purpose of feeding Skretting's ProActive feed was to stimulate the fry's immune system prior to the vaccination program. When they reached 75 fish/lb, all NSFH fish were switched to a Rangen extruded diet. The switch to Rangen bulk extruded feed allowed NSFH staff to utilize the bulk tanks, feed conveyor system, fines separator, and bridge feeders.

Final Production Rearing

Adipose fin-clipping operations are used to split the fish into even-numbered and odd-numbered raceway sections. During this program, fish are crowded to the lower 100-ft section of each odd-numbered raceway. Half the fish are clipped and put into the upper two-thirds of the raceway, while the other half are clipped into the adjacent even-numbered raceway. Fin-clipping operations started on September 27 and were completed by October 22, 2004.

Fish were given the final 100-ft of rearing space in early January. Hells Canyon fish were placed in raceways 1 through 8, while Pahsimeroi fish were placed in raceways 9 through 19. Normal fish culture techniques during this time include: feeding fish with the bridge, sweeping raceways, conducting sample counts, cleaning screens and air lines, removing mortalities, equipment maintenance, record keeping, nutrient sampling, pond scrubbing, supervising and running the adipose-marking trailer, length frequency and fin quality collection and reporting, assisting with CWT and passive integrated transponder (PIT) tagging operations, and conducting tag and mark retention checks.

Hells Canyon and Pahsimeroi steelhead were off feed for 4 days, and a total of 12 days for other fish culture reasons. These reasons include; off feed prior to handling for vaccination, adipose fin clipping, CWT and PIT-tagging programs, and off feed prior to shipping. This is a dramatic decrease from prior years, since it was not uncommon to have fish off feed for up to 45 days. Although early growth rates exceeded 0.033 inches per day, growth rates were slowed to 0.021 inches per day. Slowing the growth rates has been accomplished through feeding practices and reducing the amount of feed fed per raceway per day, but still continually feeding the fish. Past practices reduced growth rates by holding fish off feed for 5 days at a time.

A total of 360,893 lbs of Rangen and 6,600 lbs of Skretting were fed over the course of the brood year (Appendix 5). The Rangen feed total includes 36,440 lbs of Oxytetracycline (OTC) medicated feed used for a single medicated feed treatment during this brood year. OTC was fed allowing for a 21-day withdrawal time prior to stocking, meeting Food and Drug Administration (FDA) requirements. A total of nine (9) raceways did not meet this FDA requirement because of early releases of steelhead at NSFH.

The total cost of the OTC feed was $19,074.09. The total cost of regular feed was $132,167.63. A total of 369,600 lbs of fish were produced on 367,493 lbs of feed for a conversion rate of 0.994:1. Total NSFH production costs incurred by IPC during the 2004 brood year were $953,923.11, which includes IPC overhead, smolt hauling, and shop expenditures, but does not include capital outlay expenditures. The cost/lb of fish produced was $2.58 (Appendix 7).

Fin quality was assessed in March using methods developed by the NSFH personnel. NSFH personnel had previously performed fin quality measurements in March and April. However, alterations to the stocking schedule this year dictated that all fin quality measurements be taken in March to allow NSFH staff time to meet the FDA required guidelines for withdrawal periods on fish treated with MS-222 anesthetic.

Fins of steelhead reared at NSFH were compared to fins of wild, outmigrating steelhead collected from the Salmon and Pahsimeroi Rivers over a two-year period. The resulting new fin index (0.1185) will be used for all fin quality measurements at NSFH, and the Ashton Fin Index (0.13) will no longer be used. The Ashton Fin Index was based on wild Henry's Fork rainbow trout.

A total of 80 steelhead, from all four of the CWT/PIT-tagged raceways, were used for this comparison. After measuring the lengths of the dorsal and pectoral fins, a fork length was taken from each fish. By comparing the average fin length to the average fork length, a fin quality index was calculated. This index was then compared to that of wild steelhead. Results indicate that the fin quality index from fish raised at NSFH was 73.42% of that of wild fish (Appendix 8). This was a 1.84% increase from the 2003 releases using the same new index based on wild steelhead.

A target smolt size of 170 to 250 mm fork length has been established by NOAA Fisheries to maximize smolt out-migration and minimize the potential for predation by hatchery steelhead on wild salmon. To demonstrate compliance with these criteria, length frequency data were collected prior to shipping to determine fish size at the time of release (Appendix 9). The average length of PIT tagged fish sampled from four raceways in March was 194.91 mm (7.67 inches).

Fish Distribution

The IPC contracted with Neil Ring Trucking of Buhl, Idaho, to transport steelhead smolts to release sites using two IPC tank trailers. Transport of steelhead from NSFH began on March 14 and ended on April 21, 2005. Seventy-four loads of steelhead (369,600 lbs at 4.61 fish/lb) were transported to the Snake and Salmon rivers (Appendix 6). The first fish were transported to Hells Canyon (Hells Canyon stock), then to the Little Salmon River near Hazard Creek (Hells Canyon stock and then Pahsimeroi stock), and finally to the Pahsimeroi River below the weir. The Hazard Creek release site was utilized because of reduced space and high snow levels at Stinky Springs. Department biologists feel that Pahsimeroi fish do better if stocked after the second week in April (Kent Ball, personal communication).

Steelhead smolt release figures are as follows; Snake River at Hells Canyon Dam (Hells Canyon stock): 526,024 fish (106,600 lbs at 4.93 fish/lb); Little Salmon near Hazard Creek (Hells Canyon stock): 243,465 fish (51,650 lbs at 4.71 fish/lb); Pahsimeroi River below the weir

(Pahsimeroi stock): 820,667 fish (187,900 lbs at 4.37 fish/lb); and the Little Salmon near Hazard Creek (Pahsimeroi stock): 114,922 fish (23,450 lbs at 4.90 fish/lb) (Appendix 6). Total Pahsimeroi production was 211,350 lbs, or 935,589 steelhead smolts, and total Hells Canyon production was 158,250 lbs, or 769,489 steelhead smolts. Total NSFH production for the year was 369,600 lbs, or 1,705,078 fish.

Total survival to release was 82.56% for Pahsimeroi steelhead, while total survival to release for Hells Canyon steelhead was 83.19%. Overall, combined survival to release for NSFH steelhead smolts was 82.22 (Appendix 4).

FISH HEALTH

Fish health is always a concern at NSFH. The location of NSFH, in the heart of the commercial trout industry, makes it vulnerable to the horizontal transmission of many etiologic agents. Disease problems from IHNV bacterial furunculosis, and bacterial coldwater disease (CWD) have caused significant losses in years past (Munson, 1996). In addition, the NSFH and its spring-water source are located directly below agricultural land, exposing both to toxic drift and runoff from chemical application to fields above NSFH. Stringent sanitation programs and fish culture practices are implemented to facilitate disease control.

A portion of the brood year 2004 fish was vaccinated with an autogenous *Aeromonas salmonicida* bacterin obtained from Aqua Health Limited. Fish were dipped in an oxygenated solution of 18 liters of water to 2 liters of vaccine with a one-percent (1%) salt solution incorporated into the vaccination solution. The salt solution was introduced to the vaccination protocol to reduce stress brought about by physical handling and to increase the uptake of vaccine by the fish. Vaccine was applied at a rate of 220 lbs of fish per liter of vaccine, for 40 seconds. The vaccination program started on August 23 and ended on September 17, 2004. Average fish size at the time of vaccination was 102.90 fish/lb. Because Furunculosis has not been a problem in recent years (the last clinical diagnosis was brood year 1998), NSFH decided to vaccinate only 50% of the steelhead population again during the 2004 brood year. Fish were chosen for vaccination that represented both egg and fry transfers to NSFH, from both stocks of fish. No conclusions were made about the non-vaccinated vs. vaccinated fish health since there was no epizootic during this brood year. Mortalities were recorded on all the raceways each month after vaccination until shipping (Appendix 12). Munson (2001) suggests that hatchery staff and Eagle Fish Health Laboratory personnel investigate the necessity of the furunculosis vaccination in future years.

Mortality for the year was above normal. Acute losses due to infectious agents were not experienced at NSFH. The majority of losses occurred during incubation and egg losses for both stocks were very similar. Early fry losses accounted for the remainder of mortality at NSFH for the 2004 brood year. Minor losses were attributed to Motile Aeromonad Septicemia (MAS), (*Aeromonas sp.),* and CWD caused by *Flavobacterium psychrophilum*. An application of OTC - medicated feed was administered prior to release to reduce mortality due to MAS. Fish were treated for 10 days with 4% OTC incorporated into the feed in accordance with FDA Investigational New Animal Drug #9332 requirements.

The organosomatic index showed normal values in all categories for both Pahsimeroi and Hells Canyon stocks. Blood work was also taken on both stocks of steelhead at NSFH. Parameter levels for leukocrit and serum protein were normal for the Hells Canyon stock. Mean

hematocrit levels for the two Hells Canyon raceways sampled showed significant differences, 46.6% to 38.0% (Burton 2005). There were no major differences in rearing practices or environmental conditions to explain these differences.

Serum protein and hematocrit mean levels for the Pahsimeroi stock also showed significant differences between the two raceways sampled. There were no major differences in rearing practices or environmental conditions to explain the differences of 47.9% to 35.66% in these fish (Burton 2005). CTL and KTL (metric and English condition factors) were not assayed for this brood year. The condition of fish from both Hells Canyon and Pahsimeroi stocks at liberation was good.

Furunculosis, IHNV, and ERM were not isolated again at this facility during the 2004 brood year. A continuing aggressive disease management program at this facility has been effective in controlling mortality due to these etiological agents. During the first 31 years of production at NSFH, (1966-1997), the yearly mortality averaged 30.70%. During the last eight years, 1997-2004, the yearly mortality averaged 15.12%. During the last 6 years of production at NSFH, the average yearly mortality has declined to 9.40%, a decrease of more than 3 times from the first thirty-one years of production (Appendix 13).

As NSFH reduces egg request numbers and the stated management practices of the inventory continue, a reduction in losses due to MAS and CWD should occur. Hatchery personnel will need to investigate some of the new feeds breaking into the market. These feeds might help fin quality, survival, or any number of fish health parameters while balancing gains verses costs (Munson 2003). Hatchery staff should also decide whether to continue to vaccinate or to discontinue this procedure (Munson 2004).

FISH MARKING

Fin Clipping, CWT, and PIT Tags

All hatchery-reared steelhead in the state are marked with an adipose fin clip. Adipose fin clipping is done so that anglers can differentiate between hatchery and wild steelhead. The clipping process also gives the NSFH staff an accurate inventory, since all fish are counted during clipping. Steelhead were adipose-fin clipped at NSFH between September 27 and October 22, 2004.

Brood year 2004 steelhead were implanted with CWTs from September 20 to September 24, 2004. A total of 160,203 steelhead received CWTs (65,309 Hells Canyon stock, and 94,894 Pahsimeroi stock). Each tag group was held in an individual raceway section so that separate mortality information could be gathered. The CWT groups of 30,000 fish were given a 100-ft section and the one raceway with 60,000 (RCWY 12) was given 200 ft as densities increased. The fish with CWTs (Hells Canyon and Pahsimeroi stock) that were destined for the Little Salmon River were again moved into raceways closer together so that they could be shipped within days of each group. In prior years, the Pahsimeroi stock of fish that were destined for the Little Salmon River were shipped approximately a month later than the Hells Canyon stock fish. This continued practice should allow better evaluation of stock performance, as well as some possible insight into travel times for each stock, and comparisons into prior years' downstream migration times. The first fish that could be evaluated would be the returning adults in 2006, and then every succeeding year.

A total of 154,194 CWT-tagged fish were released at three release sites (Appendix 10). A total of 32,013 CWT-tagged fish were released in the Snake River at Hells Canyon Dam from March 20 through March 22, 2005, while 61,867 CWT-tagged fish were released at the Pahsimeroi weir (Pahsimeroi River) between April 5 and April 6, 2005. Both Hells Canyon stock, and Pahsimeroi stock, were released in the Little Salmon River near Hazard Creek for the 2004 brood year. A total of 30,529 CWT-tagged Hells Canyon stock were released at Hazard Creek between March 27 and March 29. The Pahsimeroi stock were released at Hazard Creek between March 29 and March 31, 2005 and totaled 29,785 CWT- tagged fish.

In addition to the CWT-tagged fish, 1,196 fish were tagged with PIT tags on February 23, 2005 (raceways 4, 8, 9, and 12). These computer chips are injected into the body cavities of the fish and information can be accessed as to hatchery origin, length, weight, release watershed, date of release, downstream migration, timing, and travel rates. In this manner, an individual fish can be tracked on its seaward migration without sacrificing the fish.

All mortalities were scanned for PIT-tag detection after tagging had occurred, prior to release and during release. Only two (2) mortalities of PIT-tagged fish occurred after the tagging was completed and prior to release. Consequently, a total of 1,194 PIT-tagged fish were released from NSFH for the 2004 brood year. Of these, a total of 298 PIT-tagged fish were released below Hells Canyon Dam (Hells Canyon stock), while 298 PIT-tagged fish (Hells Canyon stock) and 299 (Pahsimeroi stock) were released in the Little Salmon River near Hazard Creek. In addition, 300 PIT-tagged fish were released at the Pahsimeroi weir in the Pahsimeroi River (Pahsimeroi stock) (Appendix 11).

SPAWN TIMING MANIPULATIONS

Several years ago, the Department consulted University of Idaho geneticist Dr. Madison Powell for recommendations on the proper methods to move the spawn timing back to historical spawning times. Dr. Powell suggested that 10% of early-spawning steelhead and 100% of late-spawning steelhead be spawned if Department personnel desire to move the spawn timing back without impacting the existing program. Department personnel at Oxbow and Pahsimeroi hatcheries attempted to employ these recommendations again this year and will continue to do so in future years. While a high percentage of the early spawn takes were kept, the numbers were small compared to the larger lots kept later (Appendix 14).

Approximately 18% of the eggs shipped to NSFH from early spawning adults (3/25-4/12) were utilized for smolt production destined for the Pahsimeroi River, while 30% of eggs from the middle of the spawn (4/15-4/26) and 52% of eggs from late spawning fish (4/29-5/3) were utilized for smolt production at the Pahsimeroi River. At Oxbow Hatchery, 30% of early spawning fish (3/25-4/12) were utilized for smolt production back to Hells Canyon Dam, while 46% of the middle of the spawn (4/15-4/26) and 24% of eggs from late spawning fish (4/29-5/13) were utilized.

Spawn timing may also be directly correlated to winter river water temperatures. Colder winter river temperatures may delay spawning by delaying egg development in the female based on the temperature unit philosophy. However, a correlation could exist to associate winter river water temperature with ensuing spawn timing in conjunction with artificially moving

the spawn timing back by choosing eggs from later females. In the future, hatchery managers may be able to predict when the bulk of spawning will occur based on winter river water temperatures and spawn timing manipulations from preceding years.

RECOMMENDATIONS

Completed Improvements

Several hatchery improvement projects were completed this past year. Dust-Gard solution was applied again this year to the park entrance road and main springs road to minimize dust and reduce road "washboards". The subfloor and linoleum around the washer in residence one was replaced after a slow leaking washer faucet and water under the house from a broken sprinkler line were discovered. A leaking shower head and faucets in the office bathroom were repaired and the shower stall removed. All two-inch vat water valves were replaced in the hatchery building, and new one-inch incubation valves were installed to allow for more incubation hookups. A locksmith fixed all the door locks around the hatchery and adjusted the door springs. The birdnetting was repaired several times. The interior of the park restroom was repainted to cover numerous vandalism inscriptions. The paths to the lower pool were blocked off to prevent vandalism and swimming in the pool.

A new crews quarters trailer was purchased by Idaho Power Company. The four-bedroom trailer is a welcome addition for the temporary employees. A leaky water valve from a washer faucet went undetected behind the interior wall and caused extensive floor damage in the new trailer. Fortunately, the trailer was under warranty and repaired accordingly. New guardrails were installed along the lower entrance road after the new trailer ran them over because it was too long.

IPC personnel installed new power lines to four residences because of power surges in the old lines. A new transformer was added and new lines buried in the yards. New grass was planted this spring over areas that were affected by trenching. IPC personnel also renovated the incubation water collection box at the head of the springs. The old incoming water line was replaced to the box, and the box height was increased to alleviate nitrogen gas supersaturation. IPC personnel also inserted a gate valve on the feed delivery tube below each bulk tank to control the flow of the feed. They also repaired a leaky drinking fountain at the kiosk and installed a flow meter on the day-park irrigation line. IPC personnel also installed foundation vents around the three wood-frame houses to increase ventilation and prevent moisture buildup under those houses. They also made four aluminum boxes to house the flotation devices within the settling pond compound.

A new gram scale was purchased for hatchery use, and a new storage shed was also purchased and constructed near the chiller building. A new Walker riding lawnmower was purchased, along with 55 new aluminum dam boards and tools for the shop. A new hydraulic line, discharge hose, and several fittings were purchased for the fish pump.

Several landscaping projects were also completed this past year. All trees along the entrance and spring roads were trimmed for better visibility. Numerous sprinkler heads were replaced for better lawn coverage. Redwood stain was applied to all the parking barrier logs in the park. Landscaping rock was applied to new areas around the hatchery to make mowing

easier and added to existing rock areas. Soil-pep was added around all the trees and bushes on the property, and wildflowers were planted on the border with Rimview Trout Company. Both hatchery and professional crews removed dead trees around the hatchery. Numerous live elm trees were also removed around the intake to reduce the leaves and seeds that plug our raceway intake screens. Solenoid boxes were all raised so they would not fill with water from the sprinkler system. Grass was replanted in all areas where the power line trenching occurred. Weeds were sprayed in the spring and fall, and fertilizer was applied to all the grounds and park in the spring. New trees were sprayed to prevent coddling moth infestations.

Needed Improvements

Early Rearing and Incubation

An expansion of the present nursery facility to at least twelve times its present size is needed. The number of vats should be based on a desired density index of 0.30 at a fish size of 200 fish/lb or 2.5 inches in length. Using these criteria, there should be at least 15,120 ft^3 of rearing space to ensure adequate rearing space for fry. This system would protect fry from bird predation and provide them with shade from the sun.

Final Rearing

At least one more smolt-hauling truck and trailer are needed to ensure that smolts are released in a timely manner. Current hauling procedures require up to 45 days to haul fish to their respective release sites. Optimum release timing for smolts to minimize residualism and maximize downstream survival should involve fewer than half the 45 hauling days currently needed (Kent Ball, personal communication).

Concrete repair work needs to be completed at 300' on all the raceways, with additional repairs on some raceway walls. Galvanized keyways should be installed to replace the severely rusted steel keyways in the raceways. The birdnetting will have to be replaced in the near future because it requires more maintenance and is starting to deteriorate. The large bridge needs to be professionally sandblasted and painted, and a diesel-powered compressor needs to be purchased so hatchery personnel don't have to borrow the IPC shop compressor or rent one twice per month. Electrical wiring from the chiller building to the feed bins should be replaced because of entrained water in housing and consequent rust on electrical lines.

A fish counter is needed for better inventory accuracy and management. Other adipose fin clipping equipment needed includes a hydraulic pump unit, and 4 inch pump, 170 feet of 4 inch flexible line with cam locks on both ends, and a new fresh-flow pump for backup water to the trailer. A Kawasaki "Mule" or Cushman is needed for quick trips around the hatchery to haul equipment and save wear and tear on the trucks and mowers.

Employee Safety

A trash rack needs to be installed in front of the intake gate at the upper pool to prevent access to the spring and injury to the public. A trash rack should also be installed at the entrance to the discharge canal to Rimview Hatchery.

The bulk tank, conveyor line, and entrance gates to the outdoor raceways need to be raised. This is a safety issue as the low height of the conveyor line and gate doorways have caused numerous bumps and bruises.

Water Source

An intake-traveling screen is needed to remove leaves and macrophytes from the water at our intake. Entire raceways are in jeopardy every fall when leaves plug head screens during the night. Weeds also break loose from the springs all year long that could plug our head screens.

Building Improvements

A new hatchery and incubation building with functional nursery vats is badly needed. The building should also include public restrooms that are handicapped accessible, an office, shop, meeting room, and an adequate feed storage space. A three-stall garage for the trucks and mowers would be beneficial to protect these items from vandalism and weather.

A central air system should be installed in all the residences. The existing window air conditioner can't keep up with the heat produced from the metal roofs and siding, and the houses become very hot during the summer. Sliding glass doors should be installed in the living rooms of the three wood frame houses to allow access to decks and improved access to the outside for fire safety. Bathroom remodeling in all the wood-frame houses is needed, along with some kind of awning or roof over the outside decks for the two residences with the most sun exposure.

LITERATURE CITED

Ball, Kent. Personal communication, 1997

Burton, D. 2005. Niagara Springs Fish Inspection Report. Department Eagle Fish Health Laboratory. 1800 Trout Road, Eagle, Idaho.

Munson, A. D. 1996. Niagara Springs Fish Inspection Report. Department Eagle Fish Health Laboratory. 1800 Trout Road, Eagle, Idaho.

Munson, A. D. 2001. Niagara Springs Fish Inspection Report. Department Eagle Fish Health Laboratory. 1800 Trout Road, Eagle, Idaho.

Munson, A. D. 2003. Niagara Springs Fish Inspection Report. Department Eagle Fish Health Laboratory. 1800 Trout Road, Eagle, Idaho.

Munson, A. D. 2004. Niagara Springs Fish Inspection Report. Department Eagle Fish Health Laboratory. 1800 Trout Road, Eagle, Idaho.

Piper, R.G., I.B. McElwain, L..E. Orme, J.P. McCraren, L.G. Fowler, and J.R. Leanard. 1982. Fish Hatchery Management. U.S. Fish and Wildlife Service, Washington, D.C.

APPENDICES

Appendix 1. NSFH monthly water use allocations.

Month	Max. Flow	Month	Max. Flow
May	50 cfs	November	70 cfs
June	50 cfs	December	90 cfs
July	50 cfs	January	100 cfs
August	50 cfs	February	110 cfs
September	50 cfs	March	120 cfs
October	60 cfs	April	120 cfs

Appendix 2. Volume of water discharged from NSFH to Rimview Trout Company by month from November 2004 to May 2005.

Month	Hatchery Inflow	Flow to Rimview	Discharge Flow to Niagara Springs Crk.
November	68 cfs	8 cfs	60 cfs
December	90 cfs	30 cfs	60 cfs
January	100 cfs	50 cfs	50 cfs
February	110 cfs	50 cfs	60 cfs
March	115 cfs	68 cfs	47 cfs
April	66 cfs	35 cfs	31 cfs
May	0 cfs	0 cfs	0 cfs

Appendix 3. Results of annual analysis of NSFH source water, 1994 through 2005.

	Yearly Results							Maximum Allowable
Analysis	**1994 (mg/l)**	**2000 (mg/l)**	**2001 (mg/l)**	**2002 (mg/l)**	**2003 (mg/l)**	**2004 (mg/l)**	**2005 (mg/l)**	**Contaminant Levels**
Alkalinity	166	170	180	170	170	160		10.0
Antimony	0.002	N/D*	N/D*	N/D*	N/D*	N/D*		0.006
Arsenic	0.005	N/D*	N/D*	N/D*	N/D*	N/D*		0.05
Barium	0.180	N/D*	N/D*	N/D*	N/D*	N/D*		2
Beryllium	0.0002	N/T*	N/T*	N/T*	N/T*	N/T*		0.004
Cadmium	0.00034	N/D*	N/D*	N/D*	N/D*	N/D*		0.005
Chromium	0.002	N/D*	N/D*	N/D*	N/D*	N/D*		0.1
Chloride	N/T	46	44	45	41	46		250
Copper	0.010	N/D*	N/D*	N/D*	N/D*	N/D*		1.3
Cyanide	0.005	N/T*	N/T*	N/T*	N/T*	N/T*		0.200
Fluoride	0.570	0.6	0.7	N/D*	0.6	N/D*		4
Hardness	234	230	230	240	220	230		100
Iron	0.010	N/D*	N/D*	N/D*	N/D*	N/D*		0.3
Lead	0.002	N/D*	N/D*	N/D*	N/D*	N/D*		0.015
Manganese	N/T	N/D*	N/D*	N/D*	N/D*	N/D*		0.05
Mercury	0.0002	N/D*	N/D*	N/D*	N/D*	N/D*		0.002
Nickel	0.003	N/D*	N/D*	N/D*	N/D*	N/D*		0.1
Nitrate as N	1.630	1.6	1.7	1.8	1.4	1.8		10
Nitrite as N	0.01	N/D*	N/D*	N/D*	N/D*	N/D*		1
PH	8.00	8.4	8.2	8.2	7.9	8.1		6.5 - 8.5
Selenium	0.005	N/D*	N/D*	N/D*	N/D*	N/D*		0.05

*N/D = Not detected
*N/T = Not tested

Appendix 4. NSFH brood year 2004 steelhead survival from egg to smolt .

Source	**Eggs Received**	**Fry Received**	**Total Received**	**Fingerlings Released**	**% Survival Fingerlings**	**Smolts Released**	**Total Release**	**% Survival To Release**
Pahsimeroi	372,192	760,994	1,133,186	0	*83.79%	935,589	935,589	82.56%
Oxbow	461,769	463,158	924,927	0	*84.96 %	769,489	769,489	83.19%
Totals	**833,961**	**1,224,152**	**2,073,711**	**0**	***84.38%**	**1,705,078**	**1,705,078**	**82.22%**

*Estimated percentages

Appendix 5. NSFH brood year 2004 feed usage.

Manufacturer	Type and Size	Dates Received	Total Pounds Received	Total Pounds Used	Total Feed cost ($)
Rangen	Trout and Salmon Starter Swimup	6/9/04 - 8/6/04	2,100	2,100	1,153.20
Rangen	Trout and Salmon Starter #1	6/11/04 - 8/6/04	2,100	2,100	1,114.07
Rangen	Trout and Salmon Starter #2	7/12/04 - 9/7/04	2,950	2,950	1,576.98
Rangen	Trout and Salmon Starter #3	7/26/04 - 9/7/04	2,300	2,300	1,228.33
Moore Clark	Clark's Fry 1.5mm ProActive	8/7/04	6,600	6,600	3,762.00
Rangen	Bulk 470 exsl. 2.0mm slow-sink	9/3/04 - 12/1/04	76,040	76,040	31,514.00
Rangen	Bulk 470 exsl. 3/32 slow-sink	12/8/04 - 1/20/05	99,020	99,020	39,990.22
Rangen	Bulk 470 exsl. 1/8 slow-sink	1/27/05 - 4/8/05	139,940	139,940	51,905.99
Rangen	Bulk TM (4000g) 1/8 pellet	2/14/05 - 3/5/05	31,840	31,840	16,723.32
Rangen	Sack Trout Production TM (4000g) pellets 1/8	3/7/05 - 3/31/05	4,600	4,600	2,435.14
Rangen	Sack Trout Production Pellets 1/8	4/14/05	500	500	163.88
Rangen	Fines credit "exsl" bulk / sack	12/9/04 - 4/17/05	0	(363)	(146.47)
Rangen	Fines credit "TM-100" med. & "exsl" Bulk	2/30/05 - 4/30/05	0	(184)	(178.94)
	Grand Total		367,493	367,493	151,241.72

Appendix 6. NSFH brood year 2004 steelhead smolt distribution.

Destination	Stock	Weight	Dates	Number Per Pound	Number Released
Hells Canyon (Snake R.)	H.C.	106,600	3/14 - 3/24/05	4.93	526,024
Stinky Springs (Little Salmon R.)	H.C.	51,650	3/25 - 3/29/05	4.71	243,465
Pahsimeroi (Pahsimeroi R.)	Pah.	187,900	4/2 - 4/21/05	4.37	820,667
Stinky Springs (Little Salmon R.)	Pah.	23,450	3/30 - 3/31/05	4.90	114,922
Total		**369,600**		**4.61**	**1,705,078**

Appendix 7. NSFH production costs for brood year 2004.

Number of Fish	Lbs of Feed	Cost of Feed	Pounds of Fish	Feed Conversion	Total Cost	Cost per 1,000	Cost per Pound
1,705,078	367,493	$151,241.72	369,600	0.994	*$953,923.11	*$559.46	*$2.58

*Cost includes IPC cost for overhead, smolt hauling and shop expenditures and does not include capital outlay expenditures.

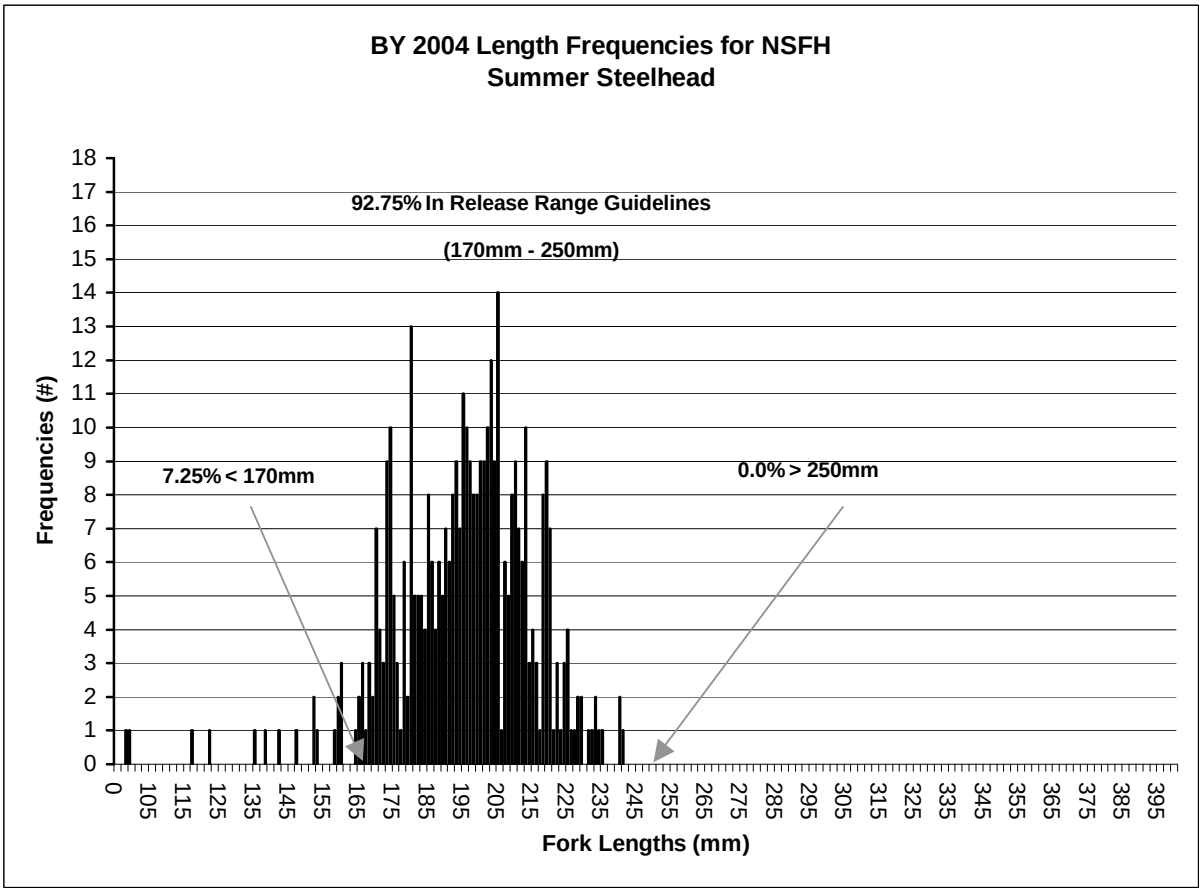
Appendix 8. Fin lengths of NSFH steelhead; March 2005.

Raceway	Fork Length	Right Pectoral	Left Pectoral	Dorsal	Ave. Fin Length	Fin Quality Index	Wild Fin Quality Index	Percent of Wild FQI
4	203.00	21.3	19.6	13.2	18.00	0.089	0.1185	75.11%
8	195.90	20.4	20.1	14.0	18.14	0.093	0.1185	78.48%
9	188.70	18.2	20.3	8.7	15.70	0.083	0.1185	70.04%
12	196.60	20.2	19.6	8.9	16.22	0.083	0.1185	70.04%
Average						0.087	0.1185	73.42%

Appendix 9. Fork length frequencies at release for three PIT-tagged raceways; March 2005.

Raceway #	H.C. 4	H.C. 8	Pah. 9	Pah. 12
Sample Size	100	100	100	100
Ave. Frk. Length	198.29	189.95	190.84	200.54
Lower Range (mm)	122.00	147.00	94.00	135.00
Upper Range (mm)	240.00	233.00	229.00	241.00

	(mm)	(Inches)
Hells Canyon Average Length	194.12	7.64
Pahsimeroi Average Length	195.69	7.70
Overall Average Length	**194.91**	**7.67**



Appendix 10. CWT summary for brood year 2004 steelhead at NSFH.

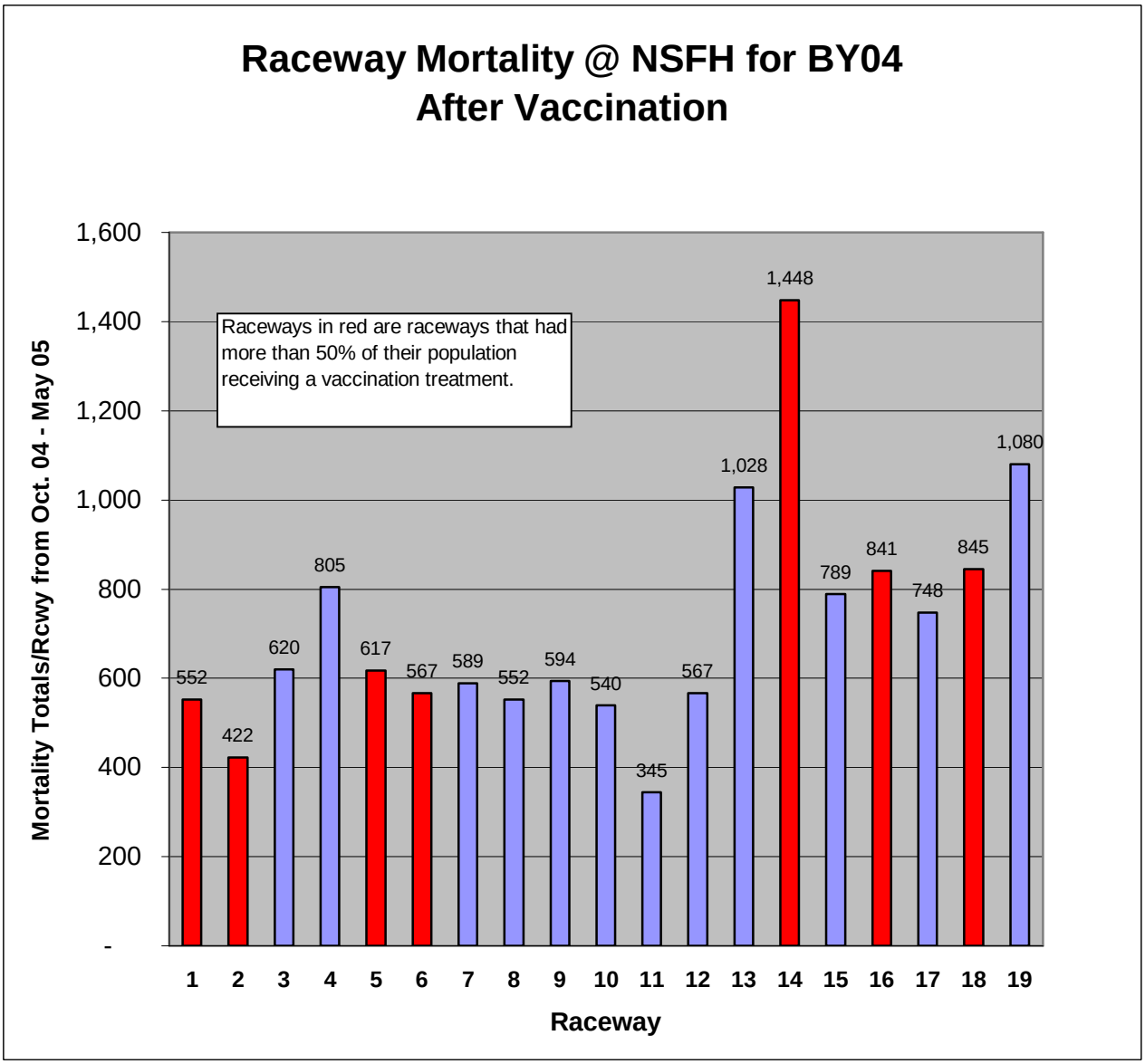
Raceway	Release Site	CWT Number	Number Tag	Mortality to Release	Number Shed	CWT Number Released	CWT Number Untagged	Total Tagged Group Release	Total Site Release
	Snake River								
4	Hells Canyon Dam	10-18-75	33,027	193	821	32,013	63,737	32,013	
Total			**33,027**	**193**	**821**	**32,013**	**63,737**	**32,013**	**526,024**
	Salmon River								
8	Little Salmon River	10-19-75	32,282	214	1,550	30,529	46,991	30,529	
Total			**32,282**	**214**	**1,550**	**30,529**	**46,991**	**30,529**	**243,465**
	Pahsimeroi River								
12	Pahsimeroi Trap	10-76-73	46,112	327	**778**	45,008	**20,637**	**61,867**	
12	Pahsimeroi Trap	10-64-70	17,275	123	292	16,859			
Total			**63,387**	**450**	**1,070**	**61,867**	**20,637**	**61,867**	**820,667**
	Salmon River								
9	Little Salmon River	10-56-76	31,507	187	**1,535**	29,785	**50,911**	**29,785**	
Total			**31,507**	**187**	**1,535**	**29,785**	**50,911**	**29,785**	**114,922**

Total CWT Release: 154,194
Total Site Releases: 1,705,078
Total Smolt Releases: 1,705,078

Appendix 11. PIT tag summary for brood year 2004 steelhead at NSFH.

Raceway	Release Site	Number Tagged	Number Released	Mortality
4	Hells Canyon Dam Snake River	298	298	0
8	Stinky Springs Little Salmon River	299	298	1
9	Stinky Springs Little Salmon River	299	299	0
12	Pahsimeroi Weir Pahsimeroi River	300	299	1
Totals		**1,196**	**1,194**	**2**

Appendix 12. Comparison of mortality in vaccinated and non-vaccinated raceways at NSFH for brood year 2004.



Appendix 13. NSFH production history, BY66 to present.

NIAGARA SPRINGS HATCHERY
HATCHERY HISTORY BY66-PRESENT

YEAR	PAHSIM. Eggs/fry Received	OXBOW Eggs/fry Received	TOTAL Eggs/fry Received	TOTAL Yearly MORT.	% MORT Yearly	FALL Releases	Salmon R. SMOLT Release	Hells C. SMOLT Release	SPRING Releases	TOTAL LBS Released	Feed fed Total	Conv.	Fish/lb
1965-66	0	3,085,194	3,085,194	---	---	---	---	---	---	---	---	---	---
1966-67	0	2,605,288	2,605,288	623,533	23.93	29,400	1,364,842	587,513	1,952,355	153,552	305,890	1.99	12.71
1967-68	0	3,215,652	3,215,652	1,209,183	37.60	0	1,664,325	342,144	2,006,469	204,251	298,450	1.46	9.82
1968-69	0	2,469,536	2,469,536	695,219	28.15	0	1,665,117	109,200	1,774,317	184,186	280,430	1.52	9.63
1969-70	1,477,695	1,927,727	3,405,422	654,022	19.21	757,500	1,608,000	385,900	1,993,900	299,235	502,410	1.68	6.66
1970-71	1,330,494	1,480,150	2,810,644	305,176	10.86	670,960	1,630,002	0	2,444,860	202,025	384,040	1.90	12.10
1971-72	1,439,842	700,061	2,139,903	153,603	7.18	215,625	1,555,050	0	1,770,675	235,375	376,080	1.60	7.52
1972-73	8,850,764	1,819,721	10,670,485	3,105,637	29.10	3,008,664	1,543,349	0	4,556,184	163,839	266,800	1.63	27.81
1973-74	3,663,990	1,264,384	4,928,374	2,953,847	59.94	0	1,960,378	0	1,974,527	187,494	319,130	1.70	10.53
1974-75	3,160,144	280,098	3,440,242	2,108,426	61.29	0	1,331,280	0	1,331,816	166,640	352,890	2.12	7.99
1975-76	2,234,978	51,559	2,286,537	513,688	22.47	40,977	1,690,390	0	1,731,872	248,708	437,600	1.76	6.96
1976-77	2,487,824	730,862	3,218,686	1,642,383	51.03	0	1,433,675	141,005	1,576,303	251,835	454,762	1.81	6.26
1977-78	2,540,728	517,250	3,057,978	1,229,537	40.21	281,208	1,266,025	0	1,547,233	154,829	370,080	2.39	9.99
1978-79	2,048,350	441,069	2,489,419	426,977	17.15	344,944	1,372,454	0	1,717,498	244,887	643,680	2.63	7.01
1979-80	2,622,425	124,814	2,747,239	203,985	7.43	548,987	1,097,060	348,220	1,994,267	314,100	629,580	2.00	6.35
1980-81	1,697,010	498,416	2,195,426	720,172	32.80	0	862,494	612,760	1,475,254	316,330	622,930	1.97	4.66
1981-82	2,003,418	298,952	2,302,370	953,015	41.39	0	995,205	354,150	1,349,355	374,350	663,850	1.77	3.60
1982-83	2,313,339	253,776	2,567,115	1,431,975	55.78	500,000	542,390	92,750	635,140	181,150	448,860	2.48	3.51
1983-84	2,749,292	709,716	3,459,008	1,849,313	53.46	449,070	752,195	408,430	1,160,625	310,000	632,400	2.04	3.74
1984-85	2,333,760	598,404	2,932,164	613,771	20.93	630,500	1,273,181	414,712	1,687,893	314,650	541,198	1.72	5.36
1985-86	1,332,152	1,582,340	2,914,492	903,999	31.02	330,640	860,358	819,495	1,679,853	339,885	580,850	1.71	4.94
1986-87	1,339,176	935,195	2,274,371	422,476	18.58	39,995	1,011,900	800,000	1,811,900	419,000	557,960	1.33	4.32
1987-88	1,640,040	1,289,029	2,929,069	775,569	26.48	404,000	872,100	877,400	1,749,500	405,515	584,290	1.44	4.31
1988-89	1,256,289	1,213,399	2,469,688	803,488	32.53	0	930,700	735,500	1,666,200	406,800	574,770	1.41	4.10
1989-90	1,925,795	833,397	2,759,192	252,892	9.17	603,000	956,100	947,200	1,903,300	465,400	597,310	1.25	4.09
1990-91	1,966,434	113,190	2,079,624	311,624	14.98	0	856,000	912,000	1,768,000	484,025	632,030	1.28	3.65
1991-92	650,400	691,500	1,341,900	311,400	23.21	0	786,600	243,900	1,030,500	232,500	283,000	1.22	4.43
		812,000	812,00	394,936	48.64	0		417,064	417,064	72,786			5.73
	Wallowa												
1992-93	1,131,951	1,013,846	2,145,797				761,800	353,600		235,075			
1992-93	Babington		*Babington	Release	In Little	Salmon	*222,560	306,907	**47,089	131,090			
			**Brownlee	Reservoir									
1993-94	954,294	1,509,596	2,463,890	1,263,820	54.89	0	928,981	609,115	1,538,096	350,151	440,143	1.26	4.40
1994-95	1,042,728	1,099,915	2,142,643	281,034	13	160,000	741,180	960,429	1,701,609	376,060	489,960	1.29	4.52
1995-96	1,400,000	1,397,103	2,797,103	906,008	32.4	157,600	890,135	843,360	1,733,495	352,750	429,528	1.22	5.00
1996-97	1,297,250	1,303,599	2,600,849	698,156	26.84	149,040	1,093,002	660,651	1,753,653	370,520	421,144	1.14	4.79
1997-98	1,434,497	1,211,977	2,646,474	992,649	37.5	0	942,430	711,395	1,653,825	361,745	412,624	1.14	4.57
1998-99	1,412,000	1,393,383	2,805,383	759,809	27.08	60,634	1,185,535	657,665	1,843,200	444,455	484,110	1.09	4.63
1999-00	1,712,675	1,133,871	2,846,546	281,131	9.87	364,923	1,011,633	792,902	2,295,605	457,626	469,043	1.02	4.30
2000-01	1,416,442	1,045,825	2,462,267	100,330	4.07	431,133	1,351,337	579,467	1,930,804	459,580	473,540	1.03	4.29
2001-02	1,502,313	950,907	2,453,220	137,481	5.60	478,586	1,310,985	526,168	1,837,153	454,430	442,864	0.98	4.11
2002-03	1,161,547	919,416	2,080,963	224,277	10.78	0	1,330,802	525,884	1,856,686	417,275	415,155	0.99	4.45
2003-04	1,151,911	921,800	2,073,711	185,403	8.94	0	1,355,364	532,944	1,888,308	409,050	388,744	0.95	4.61
2004-05	1,133,186	924,927	2,058,113	353,035	17.15	0	1,179,054	526,024	1,705,078	369,600	368,040	0.99	4.61

Appendix 14. Oxbow and Pahsimeroi stock spawn timing manipulations at NSFH for brood year 2004.

Hells Canyon Stock Eggs Used for Production Purposes				Pahsimeroi Stock Eggs Used for Production Purposes			
Lot Number	Spawn Date	Percent of Eggs Available Utilized for Smolt Production	Percent of Total Smolts Utilized for Production Back to Rack	Lot Number	Spawn Date	Percent of Eggs Available Utilized for Smolt Production	Percent of Total Smolts Utilized for Production Back to Rack
1	03/15/04	100%	0.9%	1	03/25/04	0%	0%
2	03/18/04	100%	0.6%	2	03/29/04	0%	0%
3	03/22/04	100%	0.9%	3	04/01/04	0%	0%
4	03/25/04	100%	2.1%	3a	04/01/04	0%	0%
5	03/29/04	100%	7.2%	4	04/02/04	19.9%	4.2%
6	04/01/04	100%	12.0%	5	04/05/04	0%	0%
7	04/05/04	100%	1.2%	5a	04/05/04	0%	0%
8	04/08/04	100%	2.1%	5b	04/05/04	36.3%	4.5%
9	04/12/04	100%	2.9%	6	04/07/04	0%	0%
10	04/15/04	59%	8.9%	6a	04/07/04	0%	0%
11	04/19/04	91%	8.7%	6b	04/07/04	100%	5.0%
12	04/22/04	92%	19.9%	7	04/12/04	0%	0%
13	04/26/04	100%	9.2%	7a	04/12/04	0%	0%
14	04/29/04	100%	9.6%	7b	04/12/04	0%	0%
15	05/03/04	100%	3.5%	8	04/12/04	100%	5.1%
16	05/06/04	100%	3.5%	8a	04/12/04	0%	0%
17	05/10/04	100%	3.5%	9	04/15/04	27.7%	7.1%
18	05/13/04	100%	3.5%	10	04/19/04	54.4%	14.7%
				11	04/22/04	25.7%	3.9%
				12	04/26/04	62.4%	3.9%
				13	04/29/04	100%	34.4%
				14	05/03/04	100%	17.1%

Submitted by:

R. Paul Dorman
Assistant Hatchery Manager

Jerry Chapman
Fish Hatchery Manager II

Approved by:

_____
Virgil K. Moore, Chief
Fisheries Bureau

_____
Tom Rogers
Fish Hatcheries Supervisor